## *5. Status of Russian Wheat Aphid Resistance and Outline of a New AWPM Strategy*

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**Background. Prairie Red** is a Russian wheat aphid resistant version of **TAM 107**, which was released by CSU in 1998. It has become a popular variety in parts of the state with consistent Russian wheat aphid problems. Resistance in this variety is conferred by the gene Dn4. Other varieties with this resistance gene include **Ankor, Halt, Prowers 99 and Yumar**. **Stanton**, a resistant variety released by Kansas State University in 2000, is thought to have a different gene. Combined, these varieties account for about one fourth of the wheat acres in Colorado in 2003.

**Situation.** Russian wheat aphid infestations in **Prairie Red** have been common this season in southeast and east central Colorado. Additional reports of infestations in other resistant varieties have been received from elsewhere in the state. Plants have been observed with heavy infestations and susceptible symptoms. In the past, plants occasionally had been observed with heavy infestations, but these plants always showed resistant symptoms.

Russian wheat aphids were collected from infested **Prairie Red** and placed on seedlings of resistant and susceptible varieties in the greenhouse. We observed a susceptible reaction on all varieties when we used aphids from infested Prairie Red, but we observed the expected resistant and susceptible reactions when we used aphids from our greenhouse colony (Table 1). Our initial conclusion is that there is a new strain (known as a "biotype") of Russian wheat aphid in Colorado that is virulent to **Stanton** and all CSU varieties containing Dn4. There are many questions that need to be answered about how this might have occurred and what needs to be done about it.

**What we know**

1. We have the original biotype (Biotype A) of the Russian wheat aphid in eastern Colorado and adjacent areas. This biotype has been observed this season in the field at Fort Collins and Hays, KS.

2. We have a new biotype (Biotype B) of the Russian wheat aphid. This is not a completely unexpected development, but there was no way to prepare for it because we could not identify which resistance sources to use in new varieties. We recently learned of a different biotype in Chile, and we had already taken some preliminary steps to prepare for its possible arrival. It is not known if the Chilean biotype also is Biotype B.

3. **Ankor, Halt**, **Prairie Red**, **Prowers 99**, **Stanton** and **Yumar** are effective against Biotype A and susceptible to Biotype B.

4. Biotype B infestations will need to be managed conventionally on all Colorado wheat varieties. This means that the crop will need to be scouted and treated with an insecticide if economic thresholds are exceeded.

5. Other management tactics such as biological control and cultural practices should be equally effective against both biotypes.

**What we don't know**

1. What sources of resistance can we use in future resistant varieties? There may be genes effective against both biotypes, or it may be necessary to develop varieties with a combination of genes effective against both biotypes. Our first test for Biotype B resistance is underway with over 20 different sources being tested. Several of these sources have already been used in crossing by the CSU wheat breeding program.

2. Are the two biotypes different only in their virulence to our resistant wheats, or are there other important biological or economic differences that might affect other management recommendations?

3. Where did Biotype B come from? It is possible that it adapted locally in response to the deployment of resistant varieties. The other possibility is that it is the result of a new introduction from another country. Many Russian wheat aphid biotypes are known to exist elsewhere in the world. Genetic studies by USDA-ARS at Stillwater, OK are underway in an effort to answer this question.

4. How do we tell the two biotypes apart? Currently we can collect aphids from damaged resistant varieties in the field and be fairly certain that we are collecting Biotype B. Also, we can collect from damaged susceptible plants and test aphids on resistant seedlings in the greenhouse. However, neither of these procedures provides the rapid and inexpensive answers we may need to make management decisions.

5. Will the distribution of Biotype B be different from that of Biotype A? We currently have very limited information on this subject. Information arising from the AWPM project will help answer this question.

**Outline of a New Strategy for Russian wheat aphid Management.**

Russian wheat aphid must be managed with a combination of management tactics if we are to minimize the development of future biotypes. The best management practices for the Russian wheat aphid in the future will involve new resistant wheat and barley varieties. However, future management systems must rely on a variety of pest management tactics, and not to rely solely on host plant resistance. This approach provides the best opportunity to effectively manage the pest and ensure the long-term durability of host plant resistance.

As part of the AWPM program we will enhance and update existing pest management tools, such as previously developed sampling methods and a computer based decision support system, and provide these tools to growers. We will take full advantage of the opportunities for education provided by the AWPM program to transfer these technologies to the grower community in the affected areas. In addition, we will use the opportunity to advance our knowledge of the ecology and management of the Russian wheat aphid to increase the effectiveness and scope of our pest management arsenal.